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Committee on the Peaceful Uses of Outer Space

Report on the United Nations Workshop on Space Technology for Emergency Aid/Search and Rescue Satellite-Aided Tracking System for Ships in Distress

(Maspalomas, Gran Canaria, Spain, 24 and 25 September 1998)

Contents

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I. Background

A. The International Agreement on the International Search and Rescue Satellite System

1. In time of danger or distress, including those associated with natural or anthropogenic disasters, providing an alert and associated location information is very critical to the mounting of any successful rescue operation. In 1984, Canada, France, the Union of Soviet Socialist Republics and the United States of America, desiring to strengthen the close international cooperation in this humanitarian endeavour, convinced that a worldwide satellite system to provide alert and location services for maritime, aviation and terrestrial distress and safety was important for the efficient operation of search and rescue, recalling the provisions of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, of 27 January 1967, and other multilateral agreements regarding the use of outer space to which they are party, and recognizing that it was therefore desirable to operate the International Search and Rescue Satellite System (COSPAS-SARSAT), in accordance with international law, so as to endeavour to provide long-term alert and location services in support of search and rescue and access to the System to all States on a non-discriminatory basis, and free of charge for the end-user in distress, concluded the International Agreement on the International Search and Rescue Satellite System (COSPAS-SARSAT) on 5 October 1984.

2. The purpose of the Agreement was:

(a) To assure the long-term operation of the System;

(b) To provide distress alert and location data from the System to the international community in support of search and rescue operations on a non-discriminatory basis;

(c) To support, by providing distress alert and location data, the objectives of the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO) concerning search and rescue;

(d) To define the means by which the parties should coordinate the management of the System and cooperate with other national authorities and relevant international organizations in the operation and coordination of the System.

B. The Spanish Mission Control Centre

3. The Spanish Mission Control Centre, located at the National Institute for Aerospace Technology (INTA) satellite tracking station in Maspalomas, Gran Canaria, Spain, is one of the 30 ground receiving stations of the COSPAS-SARSAT global network (see figure 1). The station was established by the Government of Spain in 1993. In addition to COSPAS-SARSAT operations, it provides tracking, telemetry and control operations for Spain's MINISAT-01, serves as a back-up tracking, telemetry and control station for the MSG satellite of the European Organization for the Exploitation of Meterological Satellites, supports the Japanese ETS-VII satellite and acquires Earth resource data from the Land Remote Sensing Satellite (LANDSAT), the Satellite pour l'observation de la Terre (SPOT), the European remote sensing satellite (ERS), SeaStar, satellites of the National Oceanic and Atmospheric Administration of the United States of America and the Indian remote sensing satellite (IRS).

II. Organization of the Workshop

4. The Spanish COSPAS-SARSAT Mission Control Centre in Maspalomas is responsible for transmitting directly any alert signal received from any of the following 21 African countries: Benin, Cameroon, Cape Verde, Central African Republic, Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Nigeria, Sao Tome and Principe, Senegal, Sierra Leone and Togo (see figure 2). All these countries can participate effectively in COSPAS-SARSAT life-saving programmes by investing in simple radio beacons whose alert signals can be identified, located and detected in time of danger and subsequently relayed to a rescue coordination centre. The absence of such a facility in many African countries has resulted in the loss of many lives that could have been saved, a situation that led to the organization of the Workshop.

5. The United Nations, in cooperation with the INTA Spanish Mission Control Centre and with the support of the European Space Agency (ESA) and the Spanish

Figure 1

Satellite visibility area of existing local user terminals in the International Search and Rescue Satellite System[a, b, c]

[a] Represents approximate System coverage at 121.5 MHz; at 406 MHz the System covers the entire globe.

[b] Local user terminals

1 Alice Springs, Australia
2 Churchill, Canada
3 Edmonton, Canada
4 Goose Bay, Canada
5 Toulouse, France
6 Hong Kong
7 Bangalore, India
8 Lucknow, India
9 Ambon, Indonesia
10 Jakarta
11 Bari, Italy
12 Yokohama, Japan
13 Wellington
14 Tromso, Norway
15 Lahore, Pakistan
16 Archangelsk, Russian Federation
17 Moscow
18 Nakhodka, Russian Federation
19 Novosibirsk, Russian Federation
20 Singapore
21 Maspalomas, Spain
22 Lasham, United Kingdom of Great Britain and Northern Ireland
23 Alaska, United States of America
24 California, United States
25 Guam
26 Hawaii, United States
27 Puerto Rico, United States
28 Texas, United States
29 Brasilia
30 Santiago

[c] Satellite

Altitude 850 km
Elevation angle 5°

Figure 2

Service areas of the mission control centres[a]

[a] ALMCC	Algerian Mission Control Centre
AUMCC	Australian Mission Control Centre
	Brazilian Mission Control Centre
BRMCC	Commonwealth of Independent
CMC	States Mission Control
	Canadian Mission Control Centre
CMCC	Chilean Mission Control Centre
CHMCC	French Mission Control Centre
FMCC	Chinese Mission Control Centre
HKMCC	Indian Mission Control Centre
INMCC	Italian Mission Control Centre
ITMCC	Japanese Mission Control Centre
JAMCC	Norwegian Mission Control
NMCC	Centre
	Pakistan Mission Control Centre
PAMCC	Peruvian Mission Control Centre
PEMCC	Singapore Mission Control Centre
SIMCC	Spanish Mission Control Centre
	United Kingdom Mission Control
SPMCC	Centre
UKMCC	United States Mission Control
	Centre
USMCC	

Ministry of Foreign Affairs, organized a workshop that addressed the issue of search and rescue in the area covered by the Maspalomas station and possible operations in the concerned West African countries. The Workshop was held on 24 and 25 September 1998, at INTA in Maspalomas. It was organized to provide those countries within the footprint of the COSPAS-SARSAT station in Maspalomas with an opportunity to gain the necessary knowledge to enable them to galvanize their national authorities into action and to ensure that their respective countries participate in the COSPAS-SARSAT programme. At the opening session of the Workshop, Julio Melian, Director and Coordinator, INTA, welcomed all participants on behalf of the Government of Spain and INTA. Mr. Adigun Ade Abiodun, Expert on Space Applications of the Office for Outer Space Affairs, also welcomed all participants on behalf of ESA and the United Nations.

6. A total of 15 participants from 6 African countries (Cape Verde, Ghana, Nigeria, Senegal, Sierra Leone and Togo), Spain and the Office for Outer Space Affairs attended the Workshop. Participants were professionals at the level of director and senior programme managers associated with and/or responsible for the operating airlines of their country; the country's maritime agency and port authorities; the geological survey and land survey departments; the telecommunications industry; or the national disaster management board or bureau.

7. The Government of Spain (through INTA as well as the Ministry of Foreign Affairs) provided room and board for all the invited participants and was responsible for all the local logistics of the Workshop. ESA and the United Nations provided funds to cover the travel and en route expenses of the same participants.

III. Summary of the Workshop

A. The International Search and Rescue Satellite System

8. The Workshop was held in two different sessions, the first of which focused on practical programmes and related operations of COSPAS-SARSAT. Subsequent round-table discussions addressed the relationship between the Spanish Mission Control Centre in Maspalomas and the individual country's search and rescue point of contact. The participants paid a visit to the Maspalomas tracking station installation and subsequently a more elaborate visit to the COSPAS-SARSAT operation room. During that visit, a demonstration was conducted with the activation of a 406 MHz radio beacon and the related location calculation by the local user terminals, with an accuracy that was better than 1 kilometre. Participants also visited the Centre for Reception, Processing, Archiving and Dissemination of Earth Observation Data and Products (CREPAD), which is co-located at Maspalomas with the COSPAS-SARSAT station.

9. In support of the COSPAS-SARSAT programme, a number of satellites have been launched by the Russian Federation (Space System for Tracking Ships in Distress (COSPAS)) and by Canada, France and the United States of America (Search and Rescue Satellite-Aided Tracking System (SARSAT)). The International Search and Rescue Satellite System, which consists of a constellation of at least four satellites in polar orbit and a network of ground receiving stations, provides distress alert and location information to appropriate rescue authorities for maritime, aviation and land users in distress.

10. Operationally, COSPAS-SARSAT provides distress alert identification and location data to rescue coordination centres emitted from radio beacons, at a frequency of 406 MHz, which transmit alert and identification messages within the coverage area of COSPAS-SARSAT ground stations' local user terminals and, in some cases, outside that coverage area anywhere in the world. Complete coverage of the Earth, including the polar regions, can be achieved using simple emergency beacons to signal distress. Figure 1 shows the satellite visibility area of existing COSPAS-SARSAT local user terminals.

11. The Workshop exposed the participants to COSPAS-SARSAT operations, including the procedure for distribution of alert signals, once they are received at the Maspalomas station, as shown in figure 3. The procedures for distribution of data, once they are received, are shown in figure 4.

12. **COSPAS-SARSAT radio beacons**. There are three types of radio beacon: aviation emergency locator transmitters, maritime emergency position-indicating radio beacons and personal locator beacons. These beacons transmit signals that are detected by COSPAS-SARSAT polar-orbiting spacecraft equipped with suitable receivers and the signals are then relayed to COSPAS-SARSAT local user terminals, which process the signals to determine the location of the radio beacon that is transmitting the signals. Alerts are then relayed, together with location data, via a mission control centre either to another mission

Figure 3

Procedure for the distribution of alert signals from the Spanish Mission Control Centre[a]

[a] FMCC French Mission Control Centre
LUT Local user terminal
MCC Mission control centre
NOCR Notification of country of registration
SPMCC Spanish Mission Control Centre
SPOC Search and rescue point of contact

Figure 4

Procedures for the distribution of data in the International Search and Rescue Satellite System

control centre or to the appropriate search and rescue point of contact or rescue coordination centre.

13. While the emergency locator transmitters are automatically activated on impact and are designed to survive such impacts, the emergency position-indicating radio beacons can be activated both automatically and manually and are designed to remain floating constantly. The personal locator beacons, which are for personal use, are activated manually and are generally used for scientific and sport expeditions in remote and isolated areas. In all cases, the operating battery lifetime for each of the radio beacons is 48 hours.

14. The first generation of distress beacons (590,000 in service to date) operated worldwide at a transmission frequency of 121.5 MHz. The latest generation, with about 135,000 in service, operate at a transmission frequency of 406 MHz. The following are the reasons for the upgrade of the transmission frequency from 121.5 MHz to 406 MHz: characteristics of the 121.5 MHz radio beacon included the low emission power of 0.1 watt; all beacons emit the same signal; there is no identification code; and there is a 25-50 km average location error. The characteristics of the new generation of 406 MHz radio beacons include high emission power (5 watt); periodic distress emissions; identification message code for maritime emergency position-indicating radio beacons, aviation emergency locator transmitters and personal locator beacons/country code/identification registration; and a 0-5 km average location error.

15. **Operational problems and possible solutions**. False alerts and interferences (40,000 detected in 1996) are the major operational problems often encountered in the use of the beacons. Two interferences in the 406 MHz band on 28 December 1996, which resulted from clandestine emissions from neighbouring countries, prevented the identification of the alert signals from the activated 406 MHz radio beacon of the Greek ship, the Dystos, resulting in the loss of life of 20 crew members.

16. Problems of false alerts can be addressed through (a) periodic inspections of radio beacons; (b) user education; (c) the mounting of receivers on the bridges of ships; and (d) through post-flight inspection of aircraft. The vigilance of local telecommunication authorities and the issuance of clear instructions by them on the dedicated use of the 406 MHz frequency band for search and rescue is very critical. Clandestine use of the 406 MHz frequency band should neither be encouraged nor go unreported. The roles of both ITU and IMO in ensuring compliance are critical.

17. **Search and rescue operations to date**. The first satellite of the COSPAS-SARSAT system, COSPAS-1, was launched on 30 June 1982. Shortly after the satellite went into operation, it began relaying signals from a downed aircraft in the Rocky Mountains in western Canada. All three persons aboard the aircraft were soon rescued. Similar stories have repeated themselves many times and from the beginning of its operations in 1982 until 1997, the COSPAS-SARSAT system with its current constellation of six satellites has been used in 2,635 search and rescue events for the rescue of 8,638 people. In 1997 alone, 1,284 people were rescued in 388 COSPAS-SARSAT search and rescue missions.

B. National status reports

18. **Cape Verde.** Two different ministries are concerned with search and rescue operations, the Ministry of Defence, through the Coast Guard, and the Ministry of the Sea and the Air, through civil aviation and the merchant navy. The search and rescue service is still not completely organized and the establishment of two centres is planned. Communication facilities, within both the military and civilian sectors, include telex and high-frequency and very high-frequency services. One small ship (15 m) and two small planes (Dornier) are available for search and rescue services. The acquisition of a bigger ship is expected in the immediate future.

19. **Ghana**. The National Disaster Management Organization was created in 1996 under the National Security Council for the management of areas affected by disasters and similar emergencies, for the rehabilitation of persons affected by disasters and to provide for related matters. Eight different committees have been created, covering geological disasters, meteorological disasters, lightning disasters, pest and insect infestation disasters, epidemic disasters, social and ethnic disasters, food security and relief and reconstruction. The Organization also works in close cooperation with neighbouring countries. There are no regulations on the use of 406 MHz emergency locator transmitters, but it seems feasible to introduce such regulations in the near future. The aeronautical fixed telecommunications network line has so far proved fully reliable. However, a west African satellite communications centre is planned and could constitute a future link to the Spanish Mission Control Centre. Ghana also coordinates search and rescue activities in Benin and Togo.

20. **Nigeria**. The National Maritime Authority has overall responsibility for search and rescue operations, although in 1997 the Inland Water Agency was created to deal with this kind of disaster. The National Maritime Authority has not yet made the use of 406 MHz beacons obligatory. The country is divided into two regions, the eastern and western. Other agencies (air force, police, civil aviation, merchant navy) support search and rescue activities under the coordination of the National Maritime Authority. The Authority has two helicopters available for search and rescue operations. Since February 1998, Nigeria has complied with the IMO Global Maritime Distress and Safety System agreement.

21. **Senegal.** Senegal is going to designate a point of contact for all matters concerning COSPAS-SARSAT. The Rescue Coordination Centre in Dakar, which acts as a coordination centre for coastal operations, is equipped with eight stations and a variety of communication infrastructure (high-frequency, very high-frequency, radar, etc.). In addition, eight boats and one plane are available for search and rescue operations. A subregional commission on fisheries, composed of six countries, works in accordance with coordinated search and rescue plans.

22. **Sierra Leone**. Sierra Leone has a Search and Rescue Committee under the Civil Aviation Directorate. The latter is composed of four oversight bodies that support national search and rescue operations. Contributing to those activities are the rescue authority (one boat); the Air Force (one helicopter); and the Navy (one speedboat). The major problems are communications, reaction time to emergencies and training facilities for search and rescue officers.

23. **Togo.** Togo comes under the search and rescue coordination of Ghana. Search and rescue operations are managed by the Air Force and the Navy. Togo's rescue coordination centre has the following resources: three high-speedboats, a radio station and two navy boats. Togo representatives will meet with the heads of the Air Force and Navy to work on COSPAS-SARSAT issues.

IV. Conclusion

24. It was proposed that a centre should be established in West Africa to work with the Spanish Mission Control Centre in order to encourage sharing of resources between the different countries:

(a) Each country should engage in a national dialogue on COSPAS-SARSAT issues with input from the Government and related organizations (such as civil aviation, maritime organizations, the air force, the navy and the natural disaster agency);

(b) Each country should designate a head of the national COSPAS-SARSAT delegation and a lead agency and send details to INTA before January 1999;

(c) Each country should designate a search and rescue point of contact and notify INTA;

(d) Each country's search and rescue point of contact should start sending feedback messages in response to messages from the Spanish Mission Control Centre;

(e) In order to participate effectively in the COSPAS-SARSAT programme, each 406 MHz type-approved radio beacon purchased for that purpose needs to be properly registered within its own country (see annex I for a sample registration card).

25. It was agreed that periodic COSPAS-SARSAT meetings were needed. The organization of such periodic meetings would be predicated upon the efforts of each country to establish the necessary COSPAS-SARSAT programme at the national level. At such meetings a national status report should be provided by each country in accordance with the format presented in annex II.

26. The Office for Outer Space Affairs of the Secretariat is prepared to work with INTA to facilitate the establishment of an appropriate COSPAS-SARSAT network in each participating African country, contingent upon the commitment of each country to establish the necessary facilities at the local level and to train the necessary manpower to operate and manage such a programme.

Annex I

Sample registration card[a]

A. Front side

406 MHz COSPAS-SARSAT distress beacon registration card																
1. Instructions for manufacturers/retailers: Please complete this section of the card. Make of beacon: .... If the beacon is: (please tick √) □ a maritime EPIRB, please ask purchaser to fill in sections 2 and 3; or □ an aviation ELT, please ask purchase to fill in sections 2 and 4; or □ a personal locator beacon (PLB), please ask purchaser to fill in section 2; and provide purchaser with address of registration authority as provided for on reverse side. The unique 15-character hexadecimal beacon identification code must be provided below (bits 26-85 of digital message).																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
2. User data: To be provided by owner: Owner's name: .... Address: .... Telephone: (home) .... Telephone: (work)... Emergency contacts: Name: .... Name: .... Telephone: (home): .... Telephone: (home): .... Telephone: (work): .... Telephone: (work):																

3. EPIRB: Details of vessel

Vessel name:
....
Vessel reg. number: ....(if applicable)
Radio call sign:
....
MMSI numbers (9 digits):
....
Vessel length: .... Gross tonnage: ....
Home port:
....

Max. number of persons on board: ☐ less than 5 ☐ 5 to 25 ☐ more than 25

☐ Sail ☐ Power inboard ☐ Power outboard
☐ Other propulsion, specify: ....
Colour of vessel:
....
Communication/navigation: (please tick √)
VHF ☐ MF ☐ HF ☐ DSC☐
Inmarsat-A ☐ - B ☐ - C ☐ - M ☐
Inmarsat phone numbers:
....
Other com. (e.g. cellphone No.): ....
Global nav. sat. systems (GPS/GLONASS) ☐
Other primary nav. systems:
....

4. ELT: Details of aircraft

Type designator:
....
Aircraft registration marks: ....
or, Aircraft operator: ....(3-letter code)
Home airport:
....

Max. number of persons on board: ☐ less than 5 ☐ 5 to 25 ☐ more than 25

Colour of aircraft:
....

Communication/navigation: (please tick √)
VHF ☐ UHF ☐ HF ☐ SATCOM voice ☐
Data ☐ VOR ☐ DME ☐ ADF ☐
Inertial nav. ☐ RNAV ☐
GLONASS/GPS) ☐
Other nav. systems:...

See instructions for purchaser/user on the reverse side of this card

B. Reverse side

5. Instructions for purchaser/user

The 406 MHz COSPAS-SARSAT distress beacon you have purchased **must be registered** with the appropriate national authority in the country identified by the country code in bits 27-36 of the beacon identification code.

After purchase, please complete this registration card and mail it to the address indicated below (as provided by the manufacturer/agent) or enquire with appropriate national authority for registration.

This card can also be used to notify change of ownership or transfer of beacon.

If your beacon has been recorded, please enter below the 15 hexadecimal characters of the *OLD beacon identification code*:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Note

The following countries have specified their own requirements for registration. Please use the appropriate national form: Australia, Canada, Chile, France, Norway, Russian Federation, Sweden, United Kingdom and United States of America.

Address of registration authority
(To be provided by manufacturer/agent)

....
....
....
....
Fax No.: .... Tel. No.: ....

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[a]

ADF	Automatic direction finder
COSPAS-SARSAT	International Search and Rescue Satellite System
DME	Distance-measuring equipment
DSC	Digital selective calling
ELT	Emergency locator transmitter
EPIRB	Emergency position-indicating radio beacon
GLONASS	Global Orbiting Navigation Satellite System (Russian Federation)
GPS	Global positioning system
HF	High frequency
Inmarsat	International Mobile Satellite Organization
MF	Medium frequency
MMSI	Maritime mobile service identity number
PLB	Personal locator beacon
RNAV	Area navigation
SATCOM	Satellite communications
VHF	Very high frequency
VOR	Very high frequency omnidirectional range

Annex II

Format for the national status report under the International Search and Rescue Satellite System

1. Search and rescue point of contact facility.
2. Agency responsible.
3. Head of national delegation.
4. National regulations concerning 406 MHz beacons.
5. National 406 MHz register (when, how, address).
6. Notification of country of registration.
7. Statistical data (number of COSPAS-SARSAT alerts received and percentage of false alerts, real alerts and undetermined).
8. Report on communication with the Spanish Mission Control Centre.
9. Report on interferences within the country detected by the Spanish Mission Control Centre.